

PATENT ABSTRACTS OF JAPAN

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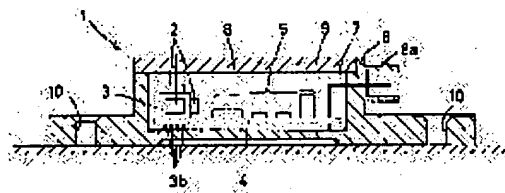
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(54) ACCELERATION DETECTOR

(57)Abstract:

PURPOSE: To enable attainment of mass production by a common structure and also to reduce the cost by a method wherein acceleration detecting elements of minute structures each of which can detect acceleration in a single-axis direction are formed to have the common structure, by using a micromachining technique, as an acceleration detector which can detect the acceleration of a moving body in a multi-axis direction, and the elements are fitted to a circuit board through a connector having fitting surfaces being vertical to the directions of the discrete axes being perpendicular to one another so that the acceleration detector be formed.

CONSTITUTION: In the acceleration detector 1, three acceleration detecting elements 2 of minute structures are connected to a circuit board 4 through a connector 3 having fitting surfaces being vertical to the directions of three axes intersecting one another perpendicularly. The circuit board 4 is provided with a processing circuit 5 which amplifies a detected electric signal, converts it into a pulse signal and takes out an acceleration signal, and these components are molded in a case 6 by a potting material 8.



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CLAIMS

[Claim(s)]

[Claim 1] Two or three acceleration sensing elements which generate an electrical signal according to acceleration are carried on the circuit board through a connector. A connector has the connection terminal which connects each sensing element to the circuit board electrically while attaching these in the clamp face which intersects perpendicularly mutually so that the acceleration of either the upper and lower sides with each sensing element right-angled to a travelling direction and this or a longitudinal direction may be detected. The acceleration detector which is equipped with the processing circuit section which carries out transform processing of the electrical signal to an acceleration signal, and consists of each sensing element on the circuit board.

[Claim 2] Said acceleration sensing element is an acceleration detector according to claim 1 characterized by combining a sensing element with a connector by making solder connection at the terminal with which the mould of the outside was carried out by resin, the terminal which can be mounted from this mould section was prepared in drawing, and it prepared this terminal in each clamp face of a connector.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the acceleration detector which can measure the acceleration of mobiles, such as an automobile, in the direction of a multiple spindle.

[0002]

[Description of the Prior Art] A micro acceleration detector is developed by the advance of the micromachining technology using microstructures, such as a ceramic and a silicon semi-conductor, in recent years, and it is observed. It is excellent also from a viewpoint of space efficiency or noise-proof nature that the sensing element of this acceleration detector is small and lightweight, and it can prepare on the circuit board including the processing circuit of the output signal etc.

[0003] There are some which were indicated by JP,63-81274,A as an example of the above-mentioned acceleration detector. This detector prepares infixed in a part of circuit board, prepares the support-at-one-end-like weight section, forms metal resistance a base and near [its] an adjoining location this weight section by etching processing, and, thereby, forms the strain gauge. Moreover, on the circuit board, the electrical signal according to the acceleration detected by the strain gauge is amplified, and the processing circuit which processes waveform shaping etc. is prepared.

[0004] As a means to need detection of the acceleration of not only a travelling direction but the longitudinal direction, the vertical direction, i.e., three shafts, or the biaxial direction in mobiles, such as an automobile, in many cases, and to cope with such a demand on the other hand While constructing a bridge circuit by the piezoresistive element which diffused and formed the impurity in a part of thin diaphragm which consists of a silicon wafer and considering as a strain gauge, the corresponding movement boss section is formed in the center of a diaphragm. The acceleration sensing element constituted so that the strain produced with the acceleration to 3 shaft orientations added to the boss section might be detected and this might be changed into an electrical signal is known. The acceleration sensing element is carried on the circuit board including the processing circuit which carries out transform processing of the electrical signal detected also in this case to an acceleration signal.

[0005]

[Problem(s) to be Solved by the Invention] However, although the first conventional acceleration detector mentioned above is a thing of a format which generally detects the acceleration of 1 shaft orientations and it is easy to detect the acceleration of a vertical direction to a component side, it is structurally [functionally or] difficult to detect the acceleration of an parallel direction to a component side. Moreover, the thing of the second conventional example is excellent in one acceleration detector in respect of the acceleration of 3 shaft orientations being detectable etc. However, since the specifications demanded by the class and the system applied of the mobile in which this is carried differ, an acceleration detector is difficult to communalize a chip and a detector to versatility, and has a problem in cost.

[0006] This invention makes it a technical problem to carry out common structuring of the acceleration sensing element of the microstructure which can detect the acceleration of the direction of a

monopodium and may be carried on the circuit board using a micromachining technology, to form it in the direction of a multiple spindle with careful attention to the trouble of the acceleration detector using the conventional micro sensing element mentioned above, to attach this in the circuit board through the connector which has a clamp face for the directions of a multiple spindle, and to offer the acceleration detector which makes fertilization possible and can carry out cost reduction with common structure.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention carries two or three acceleration sensing elements which generate an electrical signal according to acceleration on the circuit board through a connector. A connector has the connection terminal which connects each sensing element to the circuit board electrically while attaching these in the clamp face which intersects perpendicularly mutually so that the acceleration of either the upper and lower sides with each sensing element right-angled to a travelling direction and this or a longitudinal direction may be detected. It considered as the configuration of the acceleration detector which is equipped with the processing circuit section which carries out transform processing of the electrical signal to an acceleration signal, and consists of each sensing element on the circuit board.

[0008] You may make it said acceleration sensing element combine a sensing element with the terminal with which the mould of the outside was carried out by resin, the terminal which can be mounted from this mould section was prepared in drawing, and it prepared this terminal in each clamp face of a connector by making solder connection in the above-mentioned means at a connector.

[0009]

[Function] Since the acceleration detector of this invention was constituted as mentioned above, it can detect the acceleration of either a travelling direction, the vertical direction right-angled to this or a longitudinal direction by the acceleration sensing element of each shaft orientations carried in the circuit board through the connector. By considering as the component of the microstructure which has the strain gauge which applied the micromachining technology, formed the semi-conductor resistance element in the diaphragm up etc., and considered as the strain gauge combining this, or formed metal resistance by etching processing on the substrate thin film inside, an acceleration sensing element inserts anchoring and this in the circuit board, and should just fix to the connector which has a clamp face for these in the direction of a multiple spindle.

[0010] Therefore, an acceleration sensing element can be altogether made into common structure for every shaft orientations, and even if they are various specifications which change with a mobile or systems, it can be made into the thing of common structure. By this, mass production method of a sensing element is attained and cost reduction can be planned. Since an acceleration sensing element is installed in the circuit board through a connector, the direction of acceleration and the direction of the circuit board to detect can be set as arbitration, and the mounting direction is not restricted, but the free layout of it is attained. If the mould of the acceleration sensing element is carried out with resin and the terminal for mounting is taken out from this mould section, the handling nature of a component and workability will become good and its dependability will also improve.

[0011]

[Example] The example of this invention is explained with reference to a drawing below. The outline configuration of the acceleration detector of an example is shown in drawing 1. The acceleration detector 1 has three acceleration sensing elements 2 which change acceleration into an electrical signal, and these are carried in the circuit board 4 through the connector 3. The processing circuit 5 which carries out required processing of changing each detecting signal of the acceleration sensing element 2 into an acceleration signal, and amplifying it to the circuit board 4 is formed. The signal processed in this processing circuit 5 is taken out outside via the terminal 7 of harness connector 6a established in the edge of a case 6. The circuit board 4 is contained in a case 6, mould immobilization is carried out by the potting material 8 of a silicon system, and the upper part of a case 6 is closed with the lid 9. A case 6 is fixed with the screw thread to the screw-thread hole 10.

[0012] As shown in drawing 2, the acceleration sensing element 2 is formed so that it may consist of case 2a to which the mould of the whole was carried out with the resin of an epoxy system and four

terminal 2b may be exposed to a base, and it is performing supply of a power source, and ejection of a signal through this. In case 2a, as shown in drawing 3, the weight section 22 is formed in the center of the diaphragm 21 which changes from a silicon wafer to the cavernous circles, and an impurity is diffused in a part of diaphragm 21, four piezoresistive elements 23 are formed, and a strain gauge is formed combining these. Three acceleration sensing elements 2 set up the resistance of a resistance element etc. to each sensing element so that it can measure to $\pm 10\text{G}$ in the vertical direction from the vibration acceleration level actually generated on the vehicle to carry when using it for example, for automobiles, and it can measure to $\pm 1\text{G}$ to a travelling direction at $\pm 2\text{G}$ and a longitudinal direction. [0013] A connector 3 has the 4th page of three side faces horseshoe-shaped in a cross section, and top faces, as shown in drawing 2, and it consists of connector body 3a made from the resin of a nylon system by injection molding, and the acceleration sensing element 2 of each other [a top face and two side faces (going field of right-hand side and the other side)] is joined by the field of 3 right-angled shaft orientations, respectively. The conductor which appears as terminal 3b is prepared in the inner surface of connector body 3a along the field, and it connects with four terminals 3c of the brass nature which performed tinning prepared in a top face and two side faces by carrying out insert molding. although the conductor is illustrating the flat cable type -- a printed circuit -- of course, it is good also as a conductor In addition, the sensing element 2 is joined by each side by soldering. Moreover, in case it carries in the circuit board actually, the connector 3 shown in drawing 2 R> 2 is made into vertical reverse, inserts terminal 3b in the circuit board 4, and is fixed.

[0014] The block diagram of the whole circuit which connects the three above-mentioned acceleration sensing elements 2 (3 shaft orientations of X, Y, and Z) to the circuit board 4 through a connector 3 at drawing 4, and is connected to the processing circuit 5 prepared on the circuit board is shown. It is the transform-processing circuit where 51 includes an amplifier and 52 includes a Schmitt circuit, a switching circuit or an A/D-conversion circuit for waveform shaping, etc.

[0015] The acceleration detector of the example constituted as mentioned above can detect easily not only the acceleration of a direction vertical to the travelling direction of a mobile but the acceleration of the upper and lower sides which intersect perpendicularly with this, and a longitudinal direction by three acceleration sensing elements 2 attached in three fields vertical to 3 shaft orientations through the connector 3.

[0016] If $\pm 10\text{G}$ are set in $\pm 2\text{G}$ and the vertical direction and the acceleration of $\pm 1\text{G}$ is set as the travelling direction at the longitudinal direction as they were mentioned above by automobile, when biaxial or 3 shaft orientations which intersect perpendicularly were made into the travelling direction, the vertical direction, or the longitudinal direction, the acceleration also according to the actual condition is detectable. in this case -- setting out of each maximum acceleration value only sets the piezoresistive element of the acceleration sensing element 2 as the suiting resistance -- it is -- the whole configuration - - setting out of an acceleration value -- it can consider as the sensing element of common microstructure irrespective of how. Since the acceleration sensing element 2 can be easily attached in each clamp face of the connector 3 corresponding to each of 3 shaft orientations with solder and only carries out insertion immobilization of this connector 3 at the circuit board 4, it is very easy assembly operation.

[0017] Drawing 5 is the necessary sectional view of other examples. Although fundamental structure is the same as the first example, since the clamp face of a mobile in which the acceleration detector 1 is attached leans, it differs in that the connector 3 is leaned to the circuit board 4. Since the acceleration sensing element 2 is not directly attached in the circuit board 4 but he is trying to attach through a connector 3, there is no limit to the anchoring include angle of the detector itself, and a free anchoring layout is possible. In this example, the acceleration sensing element 2 is made into the thing of the detection range of $\pm 1\text{G}$ also to which shaft orientations by the premise that the acceleration of each shaft orientations does not differ not much greatly.

[0018] Thus, according to the target class and system of a mobile, the activity of a sensing element can be combined freely, and the detector which has various activities with the components of few classes can be obtained.

[0019]

[Effect] As explained to the detail above, the acceleration detector of this invention Since it constituted so that an acceleration signal might be acquired in the processing circuit section which connected to the circuit board electrically through the connector which has the clamp face of biaxial [which intersects perpendicularly two or three acceleration sensing elements with **], or 3 shaft orientations, and was prepared on the circuit board Some kinds are beforehand prepared as a thing of common structure which set up a vibration acceleration level which is different in different shaft orientations in the acceleration sensing element which detects the acceleration of 1 shaft orientations. Detection of the acceleration of the direction of a multiple spindle corresponding to a demand of the various specifications which change with each mobile or systems by attaching in each clamp face of the connector corresponding to each shaft orientations can be performed. And mass production method of the sensing element which can expect volume efficiency most is attained, and cost reduction can be planned. Moreover, since the direction of acceleration and the direction of the circuit board to detect can be set as arbitration, the anchoring direction of the circuit board is not restricted but a free layout is possible.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The main sectional view of the acceleration detector of an example

[Drawing 2] The decomposition perspective view of a connector and an acceleration sensing element

[Drawing 3] The sectional view of an acceleration sensing element

[Drawing 4] The whole acceleration detector block diagram

[Drawing 5] The main sectional view of the acceleration detector of other examples

[Description of Notations]

1 Acceleration Detector

2 Acceleration Sensing Element

3 Connector

4 Circuit Board

5 Processing Circuit

6 Case

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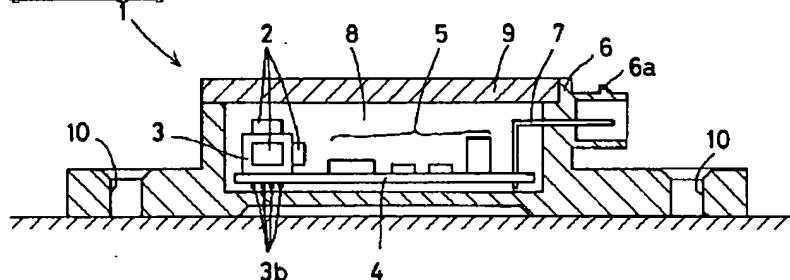
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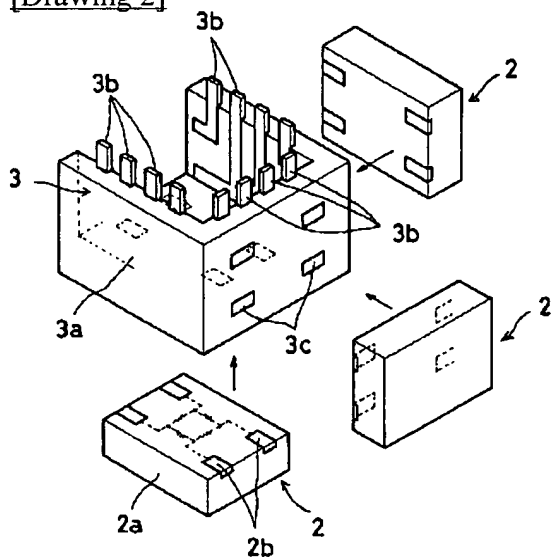
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DRAWINGS

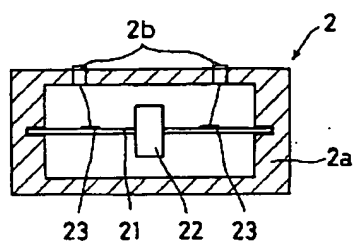
[Drawing 1]



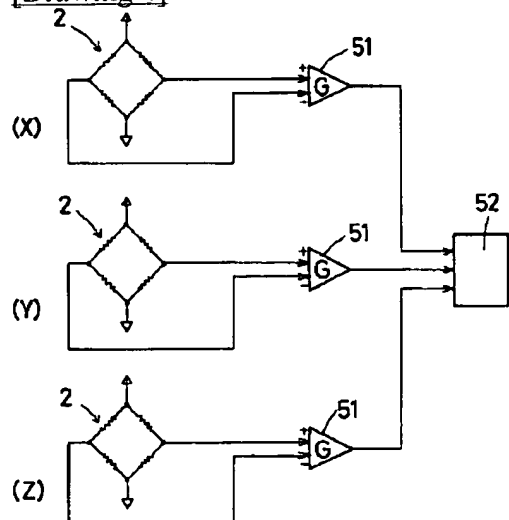
[Drawing 2]



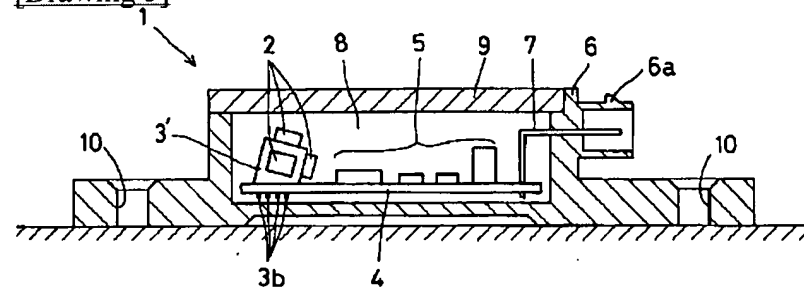
[Drawing 3]



[Drawing 4]



[Drawing 5]



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